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JC948 U.S. PTO 11/22/00

JC944 U.S. PTO 09/721062 11/22/00

PTO/SB/05 (11-00)
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	GC-409
First Inventor	Charles H. Glover et al
Title	Polymer Jacketed Fragmentation Type for Smooth Bore Guns
Express Mail Label No.	EL 595140168US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

1. [X] Fee Transmittal Form (e.g., PTO/SB/17) *(Submit an original and a duplicate for fee processing)*
2. [X] Applicant claims small entity status. See 37 CFR 1.27.
3. [X] Specification [*Total Pages* 39] *(preferred arrangement set forth below)*
   - Descriptive title of the invention
   - Cross Reference to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to sequence listing, a table, or a computer program listing appendix
   - Background of the Invention
   - Brief Summary of the Invention
   - Brief Description of the Drawings (*if filed*)
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure
4. [X] Drawing(s) *(35 U.S.C. 113)* [*Total Sheets* 8]
5. Oath or Declaration [*Total Pages* 2]
   a. [X] Newly executed (original or copy)
   b. [ ] Copy from a prior application (37 CFR 1.63 (d)) *(for continuation/divisional with Box 18 completed)*
      i. [ ] DELETION OF INVENTOR(S)
      Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. [ ] Application Data Sheet. See 37 CFR 1.76
7. [ ] CD-ROM or CD-R in duplicate, large table or Computer Program (*Appendix*)
8. Nucleotide and/or Amino Acid Sequence Submission (*if applicable, all necessary*)
   a. [ ] Computer Readable Form (CRF)
   b. Specification Sequence Listing on:
      i. [ ] CD-ROM or CD-R (2 copies); or
      ii. [ ] paper
   c [ ] Statements verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

9. [ ] Assignment Papers (cover sheet & document(s))
10. [ ] 37 CFR 3.73(b) Statement *(when there is an assignee)* [X] Power of Attorney
11. [ ] English Translation Document (*if applicable*)
12. [ ] Information Disclosure Statement (IDS)/PTO-1449 [ ] Copies of IDS Citations
13. [ ] Preliminary Amendment
14. [X] Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
15. [ ] Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
16. [ ] Request and Certification under 35 U.S.C. 122 (b)(2)(B)(i). Applicant must attach form PTO/SB/35 or its equivalent.
17. [ ] Other: ....

18. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in a preliminary amendment, or in an Application Data Sheet under 37 CFR 1.76:*

[ ] Continuation [ ] Divisional [X] Continuation-in-part (CIP) of prior application No.: 09 / 107,892

Prior application information: Examiner Tudor, H. Group Art Unit 3641

For CONTINUATION OR DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 5b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

19. CORRESPONDENCE ADDRESS

[ ] Customer Number or Bar Code Label (Insert Customer No. or Attach bar code label here) or [X] Correspondence address below

Name	SHELDON H. PARKER				
Address	300 PRESTON AVENUE SUITE 300				
City	CHARLOTTESVILLE	State	VA	Zip Code	22902
Country	US	Telephone	(804)817-6606	Fax	817-6610

Name (Print/Type)	Sheldon H. Parker	Registration No. (Attorney/Agent)	20,738
Signature	[signature]	Date	11/22/00

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11/22/00

FEE TRANSMITTAL for FY 2001

Patent fees are subject to annual revision.

TOTAL AMOUNT OF PAYMENT ($)

Complete if Known	
Application Number	
Filing Date	November 22, 2000
First Named Inventor	Charles Glover et al
Examiner Name	
Group Art Unit	
Attorney Docket No.	GC-409

METHOD OF PAYMENT

1. [X] The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to

Deposit Account Number: 16-0478

Deposit Account Name: Sheldon H. Parker

[X] Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17

[X] Applicant claims small entity status. See 37 CFR 1.27

2. [X] **Payment Enclosed:**

[X] Check [ ] Credit card [ ] Money Order [ ] Other

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	710	201	355	Utility filing fee	355
106	320	206	160	Design filing fee	
107	490	207	245	Plant filing fee	
108	710	208	355	Reissue filing fee	
114	150	214	75	Provisional filing fee	

SUBTOTAL (1) ($) 355.00

2. EXTRA CLAIM FEES

			Extra Claims		Fee from below		Fee Paid
Total Claims	37	-20** =	17	X	9	=	153
Independent Claims	6	- 3** =	3	X	40	=	120
Multiple Dependent						=	628.00

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	80	202	40	Independent claims in excess of 3
104	270	204	135	Multiple dependent claim, if not paid
109	80	209	40	** Reissue independent claims over original patent
110	18	210	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 628.00

***or number previously paid, if greater; For Reissues, see above*

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for *ex parte* reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	390	216	195	Extension for reply within second month	
117	890	217	445	Extension for reply within third month	
118	1,390	218	695	Extension for reply within fourth month	
128	1,890	228	945	Extension for reply within fifth month	
119	310	219	155	Notice of Appeal	
120	310	220	155	Filing a brief in support of an appeal	
121	270	221	135	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,240	241	620	Petition to revive - unintentional	
142	1,240	242	620	Utility issue fee (or reissue)	
143	440	243	220	Design issue fee	
144	600	244	300	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Processing fee under 37 CFR 1.17(q)	
126	180	126	180	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	710	246	355	Filing a submission after final rejection (37 CFR § 1.129(a))	
149	710	249	355	For each additional invention to be examined (37 CFR § 1.129(b))	
179	710	279	355	Request for Continued Examination (RCE)	
169	900	169	900	Request for expedited examination of a design application	

Other fee (specify) ________________

*Reduced by Basic Filing Fee Paid **SUBTOTAL (3)** ($)

SUBMITTED BY				Complete *(if applicable)*	
Name *(Print/Type)*	Sheldon H. Parker	Registration No. *(Attorney/Agent)*	20,738	Telephone	(804)817-6606
Signature				Date	11/22/00

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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	09/107,892
Filing Date	6/30/98
First Named Inventor	Charles H. Glover et al
Group Art Unit	3641
Examiner Name	Tudor, H.
Total Number of Pages in This Submission	
Attorney Docket Number	

ENCLOSURES *(check all that apply)*

- [X] Fee Transmittal Form
  - [X] Fee Attached
- [ ] Amendment / Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [X] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Response to Missing Parts/ Incomplete Application
  - [ ] Response to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Assignment Papers *(for an Application)*
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [X] Petition
- [ ] Petition to Convert to a Provisional Application
- [X] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ______
- [ ] After Allowance Communication to Group
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to Group (*Appeal Notice, Brief, Reply Brief*)
- [ ] Proprietary Information
- [ ] Status Letter
- [X] Other Enclosure(s) *(please identify below)*:

Remarks: Fee paid to maintain case copending with concurrently filed continuation-in-part.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm *or* Individual name	Sheldon H. Parker 20738
Signature	[signature]
Date	11/22/2000

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, Washington, DC 20231 on this date: 11/22/2000

Typed or printed name	Sheldon H. Parker		
Signature	[signature]	Date	11/22/2000

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Certificate of Mailing under 37 CFR 1.8

Utility Application, Declaration, Power of Attorney, Fee Transmittal, Drawings, Utility Application Transmittal

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EL595140168US

Assistant Commissioner for Patents
Washington, D.C. 20231

on ~~November 22, 2000~~.
Date

Signature

Mistie Dyke
Typed or printed name of person of signing Certificate

Note: Each paper must have its own certificate of mailing, or this certificate must identify each submitted paper.

CONTROLLED ENERGY RELEASE PROJECTILE

BACKGROUND OF THE INVENTION

Cross-reference to related patent applications.

This application is a continuation-in-part of copending US Patent Application Serial Number 09/107892, filed 6/30/98, the disclosure of which is incorporated herein by reference, as though recited in full.

Field of the Invention

The present invention relates to a fragmentation type projectile for antipersonnel use, and more particularly, to a fragmentation type projectile having increased stopping power and after initially hitting a target, having a decreased lethal range.

Brief Description of the Prior Art

The problems associated with ammunition missing, or going through the target, and hitting an innocent bystander has long been acknowledged. Various methods of resolving the problem have been approached, however none have eliminated the inadvertent injuries and deaths.

Various forms of smooth bore shotgun projectiles, specifically buckshot and slugs, originally designed for use in hunting big, and /or dangerous game animals, are well known in the art. Although these designs are the most common types of shotgun ammunition used by the law enforcement community, their excessive destructive capabilities have always presented liability problems in law enforcement situations.

These projectiles are designed for deep penetration in game animals weighing up to one thousand pounds. With only a fractional loss of energy, they will completely penetrate a human sized

target. The small percentage of energy transference to the target make these hunting projectiles very inefficient, and dangerous for use in crowded urban environments. Both slugs and larger sizes of buckshot are capable of passing through multiple residential type interior walls, and/or non-masonry exterior walls, while retaining lethal energy.

Shotgun projectiles have been designed typically to have either a single projectile, or core element (slug), or multiple projectiles, or core elements (shot or pellets). In the multiple projectile, or core element design, a shot cup or hull protects the projectiles from deformation inside the shotgun barrel and upon exit from the barrel separates from the core elements prior to impact.

Typically, this shot cup or hull is slit and peels back during flight, due to wind resistance. The pellets then travel in a progressively spreading pattern and impact a target as a collection of individual particles whose impact area is dependent upon the distance the pellets have traveled.

A target struck by small, less dangerous multiple individual pellets receives very little post impact trauma or blunt trauma injury, as the individual pellets displace minimal kinetic energy, which is lost rapidly during flight or upon the first impact. By way of contrast, a slug and to a lesser extend large buck shot, generally hits with enough kinetic energy and penetration to produce blunt trauma injury, over penetration of an initial target and lethality for an extended period of travel beyond. The difficult problem of achieving a balance between the safer, small and inefficient individual pellet impact and the dangerous, but effective slug impact, is not only achieved by the process and projectile of the present invention, but is achieved in a controlled manner.

The disclosed unique type of projectile will penetrate an initial barrier, create a secondary incapacitation zone of several feet or greater if so desired, and then become non-lethal down range. It

is through a controlled expansion process that the present ammunition achieves a result that is different from any ammunition ever designed.

BRIEF DESCRIPTION OF THE DRAWINGS

The objects and advantages of the invention will become apparent from the following description of the invention, particularly when read in conjunction with the drawings, in which:

Figure 1 is a side elevation view, partly in section, of a projectile in accordance with the present invention;

Figure 2 is a side elevation view, partly in section, of another embodiment of a projectile in accordance with the present invention;

Figure 3 a side elevation view, partly in section, of the projectile of Figure 2, shown without the core particles;

Figure 4 is a side view of an actuator of the present invention;

Figure 5 is a side elevation view, partly in section, of a further embodiment of a projectile in accordance with the present invention;

Figure 6 is a side elevation view, partly in section, of the embodiment of Figure 5, shown with the actuator of Figure 4 positioned within the hull;

Figure 7 is a side elevation view, partly in section, of the embodiment of Figure 5, shown with the actuator of Figure 4 and core particles positioned within the hull;

Figure 8 is a side elevation view, partly in section, of the embodiment of Figure 7, shown after an impact with a target, and showing the initial peel back of the hull;

Figure 9 is a side elevation view, partly in section, of the embodiment of Figure 8, shown the hull fully peeled back, the core particles and actuator separated from the hull, and the actuator preceded by a pressure wave;

Figure 10 is a side view of the core particles and actuator of Figure 9 impacting a secondary region of a target;

Figure 11 illustrates an initial stage in which core particle mass are bundled behind an actuator, and illustrates a pressure wave preceding the actuator;

Figure 12 illustrates a subsequent stage in which the core particle mass of Figure 11 have begun to spread, and showing the actuator preceded by a pressure wave that has diminished as compared to the stage shown in Figure 11; and

Figure 13 illustrates a latter stage in which the pressure wave has subsided and the core particles are dispersing radially and in advance of the actuator;

Figure 14 illustrates a side view of the core particle dispersal when the hull peel back is too slow

Figure 15 is a partial cut away view of a hull embodiment having tapered walls;

Figure 16 is a side view of an actuator in accordance with the disclosed invention;

Figure 17 is a side view of another actuator embodiment with the cone having a smaller angle;

Figure 18 is a side view of an alternative actuator embodiment having a small angled cone;

Figure 19 is a side view illustrating the controlled failure of the actuator of Figure 16 or 17;

Figure 20 is a side view of the outer ring resulting from the controlled failure of Figure 19;

Figure 21 is a graph comparing the core particle spread using an actuator having a stem to an actuator without a stem;

Figure 22 illustrates the actuator of Figure 18 undergoing controlled failure;

Figure 23 is a side view of the actuator of Figure 22 after separation of the actuator ring;

Figure 24 is a side view of the separated actuator ring;

Figure 25 is a cutaway side view of an alternate projectile embodiment using a sliding hull;

Figure 26 is a side view of the hull of Figure 25 with the hull slid into the particle release position; and

Figure 27 is a side view of an alternate embodiment using a bonding agent to adhere the core particles.

SUMMARY OF THE INVENTION

A projectile is provided, in accordance with the present invention that includes a gas seal, a wad absorption zone, a core hull, a mass of projectile core particles within the hull and an actuator member.

The hull is a cylindrical member having an open end and made from a material, such as soft plastic, that is characterized by the ability to peel back upon itself on impact, thereby releasing the mass of core particles after impact. The actuator, is releasably fixed to the hull open end, has an exterior side and an interior side and one or more stem members projecting into the mass of core particles. Prior to impact the actuator maintains the core particles within the hull. Upon impact, the actuator is released from the hull open end and continues to be propelled forward, along with the core particles. The actuator member is at the lead or impact end of the projectile and the absorption zone is at the trailing end, upstream of the core particles.

The core particles have a diameter substantially in the range from about .01 of an inch to about .13 of an inch and preferably in the range from about .02 of an inch to about .05 of an inch for a controlled lethality zone. The particles are very fine and individually do not inflict a lethal wound.

The hull preferably has an internal channel proximate its open end that interacts with a peripheral, circular ring mounted on, or integral with, the actuator. In the preferred embodiment, the actuator has a truncated conical section having tapered sides. The actuator is positioned within the hull internal channel such that its tapered sides have its greatest radial dimension at its exterior side. The actuator's circular ring is positioned on the interior side of the truncated conical section of the actuator.

The process involves igniting an explosive charge thereby projecting the projectile along a substantially straight trajectory. The explosive charge impact is absorbed thus preventing the core particles from compressing into a unified structure that will not disperse into individual fragments.

The disclosed projectile design travels as a unified unit, with the hull and contents remaining intact until impact. This is the complete reversal of the action of the shot cup or hull and core particles in typical shotgun shells. In the prior art, the wad, shot cup combination peels away and does not travel along with the core particles, let alone contain the particles. The particles fan out and travel along an elongated path. The target is thus impacted by a large number of individual spaced apart particles. The particles are spaced apart both in a fan like manner, and like a train. To the extent that particles continue to travel along the same path, the impact is like the first car of the train hitting, followed in time by the second car, then the third car, etc. The multiple individual impacts have less penetration power and energy transfer than a unified slug.

In the present invention the core particles are contained within the hull until a target is impacted by the projectile. When the projectile impacts a target, the hull peels backward upon itself thereby releasing the actuator and the mass of projectile core particles. The peel back of the hull must be at a rate equal to the velocity of the travel of the pellets thereby causing the core particles to be released essentially simultaneously. The essentially simultaneous release of the particles serves to maintain the pellets as an integrated, uniform, co-acting unit.

The forward movement of the actuator and mass of tightly grouped projectile core particles creates a pressure wave and subsequent trailing low pressure area that serves to maintain the core particles in a confined zone behind the actuator.

. The actuator and pressure wave initially maintains the projectile core particles in a confined zone behind the actuator for a controlled, predetermined distance. The example used herein uses distances of up to about ten feet, but preferably about three feet, changing the actuator, core particle size and hull can change the distances. Within the confined zone the mass of projectile core particles have a lethal impact effect substantially equivalent to that of a unitary projectile, and substantial penetration force. By acting as a unitary mass, the pellets impact a target in a manner analogous to that of a large diameter slug.

Beyond the confined zone, the projectile core particles travel in a progressively expanding pattern such that the particles travel as substantially discrete individual particles and upon impact with a secondary target produce a plurality of non-lethal individual impacts.

DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

The law enforcement requirements for tactical ammunition are extremely specific and appear to be mutually exclusive. First, the ammunition must be capable of incapacitating an individual upon

initial impact as quickly as possible. Second, it needs to do so with either a direct impact, or after passing through a barrier, such as a car windshield, a residential partition wall, or a residential door, used by the criminal as a shield. However, as a third requirement, it needs to pose as little threat as possible to innocent bystanders or people down range from the shooting position. For example, if a round is fired in an apartment building, the round must not endanger residents in neighboring apartments.

Conventional ammunition with a solid lead design, or with a solid lead core and a copper jacketing material, meets the first requirement reasonably well. This type of ammunition can be configured in an expanding design that will impart a fair amount of energy through the expansion process. This energy generally incapacitates the target upon impact. It meets the second requirement extremely well in that it only loses energy through contact resistance and can travel with lethal energy for hundreds of yards after an impact with something as non-resistant as a residential partition wall. The third requirement is where the conventional ammunition design fails, since it is designed to penetrate an initial barrier and retain lethal force beyond, there is a sacrifice of down range safety.

In an effort to create safer designs, ammunition designers have for many years experimented with "pre-fragmented" rounds that contained a plurality of sub-munitions inside a "hull", (typically a copper jacket similar to that on a conventional bullet). In the prior art the design and operation of these rounds fall into one of two groups. The first is designed with loose particles inside the hull or jacket, and bursts into an uncontrolled spray of particles upon initial impact. The second type is comprised of loose particles that have been swaged into a solid mass, or bound together into a solid mass by some type of compound, such as epoxy. This second type of projectile is designed to penetrate solid obstacles, such as partition walls, and only break apart upon contact with a viscous media.

The first type of "pre-fragmented" round is much safer when deployed close to bystanders than conventional ammunition due to the fact that the round bursts into non-lethal particles upon the first impact. This type of round has never met with favor in police work because of its lack of effectiveness when the need arises to shoot through an initial barrier and disable someone on the other side.

The second type of "pre-fragmented" round is more effective in law enforcement scenarios but can be just as dangerous and prone to over penetration as conventional ammunition if it takes flight through a house, apartment or business complex.

The present invention provides for the unique combination of the full impact of a unitary structure while providing for radial dispersion of the impact energy. This is accomplished in three stages. The first stage is a forceful initial impact similar to that of a solid slug. The second stage is a short secondary zone, downstream of the point of initial impact, in which the projectile particles are lethal, but have slightly reduced penetration and a broader blunt trauma zone than that of standard tactical shot gun ammunition.. In the third stage the particles have succumbed to air resistance and have become non-lethal or harmless.

The projectile converts upon an initial impact from (1) a unitary structure to (2) an expanding body of individual particles that continue to act as a unitary structure and (3) within a controlled distance, becomes a mass of discrete particles that rapidly lose their ability to injure. Stated another way, the projectile (1) initially acts like a slug, then (2) acts like a slug of substantially increased diameter and then (3) becomes a non-lethal object.

The increased diameter of the projectile after initial impact and unified formation of the core particles produces an impact comparable to that of a very high caliber projectile. The disclosed projectile, when the initial impact and expansion is within a body, produces a wide pressure or shock

wave that can produce a lethal and immediately incapacitating impact upon organs. Incapacitation is critical in tactical situations, as for example in interaction with terrorists the need is to disable the terrorists immediately before they can react with deadly consequences.

In order to instantaneously incapacitate a terrorist it is essential that the projectile expand rapidly enough to completely decelerate within the internal organs, imparting all its energy without over penetration. The forward shock, or pressure, wave that is generated will impact the internal organs in advance of the projectile particles and a rebounding shock wave will impact the organs a second time. The rebounding pressure wave is the original wave reflected off of, and amplified by, the interior surface opposite the point of entry. The core particles will embed into the first surface, such as an organ or tissue, which has a density sufficient to stop their forward movement. This has been demonstrated by firing the projectile into a large plastic container of ballistic gelatin. The projectile blew apart the container without penetrating the rear of the container. The front of the container is considered to be the first side impacted by the projectile and the rear is the opposite side of the container. It has been found that a zone of expansion from first impact to very low potential for lethal impact that is initially seven (7) to ten (10) feet, in free flight, is compressed to seven (7) to ten (10) inches in various viscous materials. In water, full projectile expansion and deceleration occurs within approximately four (4) inches of penetration, in ballistic gelatin approximately seven (7) inches, and in animal tissue and organs seven (7) to ten (10) inches.

A typical round of conventional ammunition can penetrate the body and produce little immediate incapacitation. By way of analogy, the need is to hit the terrorist with a high velocity bowling ball rather than a high velocity spear. The spear can eventually produce death due to bleeding but would not prevent the terrorist from continuing to function for some limited period of time,

perhaps as long as several hours. The wide spread blunt trauma of the bowling ball impact would immediately stop the terrorist from continuing to function. If the terrorist is wearing a bulletproof vest, immobilization can only be achieved by impacting the terrorist with a huge amount of energy over a confined area.

It is also seen that this projectile can penetrate a first barrier and retain its lethal efficacy for a limited distance. The impact on the terrorist also must be such that the terrorist is immediately incapacitated by the blunt trauma impact of the expanding mass of core particles, even though the projectile had penetrated a protective barrier such as a wall or car windshiled. However, in the event that the terrorist provides the first impact object, the projectile must become non-lethal after impacting the terrorist. The limitation of the distance should be such that a terrorist cannot seek shelter directly behind a residential type partition, a wall or a door, but innocent parties who are at a significant distance from the wall or behind a second wall, would not be exposed to danger.

Law enforcement officers are sometimes killed by "friendly fire" when a fellow officer's projectile travels through an auto or partition wall, striking them on the other side with enough force to defeat their body armor. With the disclosed projectile design, after an initial impact the expanding projectile has increased blunt trauma potential but greatly reduced potential for penetration. In its expanding form it may still incapacitate but is much less likely to kill a person wearing body armor standing adjacent to the auto or partition wall. And, since the distance over which the projectile changes from lethal to non-lethal particles, is now pre-designed into the projectile, unprotected people beyond the lethal range of the core particles would only receive slight abrasions if any injury at all.

Since there can be a point of second impact within the lethal zone, the energy must dissipate rapidly subsequent to the second impact such that the particles become non-lethal and that there can be no third lethal impact point at a point distant from the last impact zone.

The operation of the projectile of the present invention is unlike prior technology. As for example, in the case of the original Glasser bullet design, that has a plurality of round particles in a metal jacket, when the bullet hits it bursts immediately into non-lethal particles and there is no secondary lethal zone. The looser the core of particles the greater the dispersion. In the latest Glasser design the core particles are typically swaged to form somewhat solidified slug that can penetrate multiple layers of glass or partition walls and will only break apart into non-lethal particles after impact with viscous material.

Due to the size of the projectile a heavy recoil would be produced using a low burn rate powder to produce a high velocity projectile. Since tests have provided no advantages to using a supersonic velocity, disclosed projectile preferably uses a high burn rate powder that produces subsonic velocity. This lower speed dramatically reduces the recoil while increasing the stability of the projectile in flight.

Figure 1 is an illustration of a projectile, indicated generally as 100. The overall structure, as for example the gas seal, the wad for absorbing the impact of the firing of the projectile and a core of particles is generally in accordance with the designs and concepts of the prior art. However, the hull or shotcup 102, the actuator 106 and the core particles 120, and the interaction between the various parts are unique to the present invention.

The hull 102 contains the mass of core particles 102 which are contained within the hull 102 by folding over the upper end 104 of the hull 102 to lock the actuator 106 in place. The size of the

particles contributes to the effectiveness of the disclosed projectile. The use of fine particles is essential to change a secondary impact from lethal to non-lethal in a short distance.

The hull of the disclosed projectile must have some expansion capabilities, however to great an expansion and the release is uncontrolled. Insufficient expansion will cause the projectile to rupture or tear rather than peel back. The preferred material is a low density polyethylene, low mold grade, or a material having equal performance.

As can be seen in the Figures, the projectile 100 is a single piece unit, which makes the material selection critical. The base 124 provides the gas seal and is exposed to about 8000 psi gas pressure upon firing. The crush section 126 must be able to withstand the impact force during firing and return to its expanded position. The hull 102 must have the ability to be configured to affect a controlled peel back. The one material must meet the foregoing three very different responses in order for the disclosed projectile to perform as described.

The individual, fine particles do not have penetration power as individual particles and are rapidly slowed down by air resistance. To prevent the core particles 120 from compressing into a unified body that would resist separation upon impact, a conventional wad absorption zone is used to absorb the initial force of the gun power.

Maintaining the projectile as an integrated or unified acting body of expanded diameter is achieved through the use of the actuator. The actuator also serves to dam up the particles and keep them confined within the hull 120. The actuator is preferable a thumb-tack like structure that keeps the individual particles from immediately spreading directly after an initial impact and becoming ineffective with respect to being able to render a terrorist incapacitated. The actuator works in

conjunction with the hull to produce a three stage transition from a slug, to a wide diameter blunt trauma producing object and then to non-lethal individual particles.

In Figure 1, the actuator 106 does not contain a stem which, in some uses where controlling the lethal range is not critical, is advantageous. In most applications, however, the stem provides necessary stability to the actuator. As seen in Figure 21, the core particles 2100 follow behind the actuator 2102 when the stem is present to provide a stable flight. When an actuator 2112 without a stem is used, the core particles 2110 expand outwardly as the actuator 2112 tips.

After an initial impact, the actuator maintains the particles as a unified body of increased diameter but still traveling as an integrated body over the predetermined distance of the secondary zone. If the particles spread randomly, or too quickly, impact can be that of hundreds or thousands of minute, non-lethal particles thereby negating the desired trauma effect of the secondary impact zone. Through the use of controlled expansion, the particles impact over a confined area, comparable to that of a very large caliber projectile. The term "very large caliber projectile" is intended to indicate that the effective diameter of the projectile is increased by a factor of at least two and preferably, at least four. Since surface area of a circle increases with the square of the radius, the doubling of the diameter or caliber increases the impact area four fold.

When the pressure wave dissipates, at approximately four to five feet from core particle release, the motion of the actuator 106 is resisted by air resistance, and the particles disperse around the actuator. Radial dissipation of energy is the net result. The lethal zone is thus reduced from 300 feet, for conventional ammunition, to about three (3) feet in the disclosed design. It is possible to shoot through a wall, door, metal sheet, etc, with the lethal force carrying over to immediately downstream

of the initial penetration for roughly three feet. Therefore, although a criminal proximate the door would be struck with debilitating force, a neighbor in an adjoining apartment would not be endangered.

The particles 120 must be discrete particles such that the mass fragments into individual minute particles. Because of the versatility of the disclosed projectile, the size of the core particles is dependent upon the end use. As disclosed herein, the core particles have a lethal range of less than seven feet. Because of this short range, the particle sizes is preferably in the range from about .01 inch to about .13 inch. Most preferably, the range is from about .02 inch to about .05 inch. The small size and mass of the individual particles causes them to have a short flight path when exposed to air resistance.

To provide the controlled lethal range described herein, the core particles must be spheres, remaining separate from one another. The use of flake power rather than spherical core particles causes the interior particles to swage together under the pressure of the impact, creating a solid mass that penetrates and precedes down range from an intial impact, similar to a slug.

To increase the lethal range, the particle size is increased, along with actuator angle adjustments. To increase the lethal range to about thirty (30) feet, the size of the particles would be increased to about .13, along with a reduction of the angle of the actuator cone.

Figure 2 illustrates an alternate embodiment in which the actuator 206 has a thumb tack like shape. The projectile 200 is otherwise essentially the same as in the prior embodiment. The hull 202 has a folded over end 204 that holds the actuator in place and the hull 202 is filled with thousands of discrete particles 220. In Figure 3 the projectile 200 is illustrated without the core particles 220 and the stem 208 of the actuator 206, is thus visible.

It is preferable in all embodiments that the end of the actuator be pointed. Although this is not a necessity for performance, it makes the insertion of the actuator into the hull filled with core particles easier. The length of the actuator stem must be about 2/3 of the length of the hull. At about the 1/3 point the actuator becomes unstable during flight since there is too little contact with the core particles. At a length substantially greater than 2/3 the stem will contact the hull base during the compression upon impact. Even if the stem does not punch a hole in the base of the hull, the impact will throw the actuator out of alignment during flight.

An alternate embodiment of an actuator 406 is shown in the enlarged view of Figure 4. The actuator 406 has a circular flange 404 that locks into the circular channel 504 in the upper end of the projectile 500 hull 502, as illustrated in Figure 5. The tapered side 408 of the actuator 406 form a frusta-conical shape that is based on the circular flange 404. The open end of the hull 502 has a tapered top wall 506 that is configured to match the tapered side 408 of the actuator 406.

In Figure 6 the actuator 406 has been placed within the projectile 500. It can be seen in this Figure how the tapered side 408 of the frusta-conical section mated against the tapered wall 506 of the hull 502. Similarly, the circular flange 404 of the actuator 406 is shown locked into the circular channel 504. The projectile 500 is illustrated fully assembled in Figure 7 wherein the core particles 520 have been sealed within the hull 502 by the actuator 406. The actuator 406 has a cap 504 that has a diameter equal to that of the hull 502 thereby causing the cap 504 to rest on the rim of the cylindrical portion of the open end of the hull 502. This overlap serves to prevent the actuator 406 from angling or shifting during insertion. The cap 504 further prevents the actuator 406 from sinking into the hull 502 and bringing the stem 408 beyond the functional depth.

The projectile must produce essentially the same results when passing through steel plate, a car door, a car windshield or a residential interior wall or exterior wall. It has been found that when the actuator impacts a very rigid surface, such as a substantial gage metal plate, the actuator head 1570 will, as illustrated in Figures 17, 19 - 20, enter into a controlled failure, curving back or cupping, upon penetration of the metal. In this manner, the core particles are maintained in a dense cluster and provide greater penetration power than if permitted to disperse laterally. At the moment of penetration between the forward momentum of the core particles pushing forward against the inside curvature 1582 of the actuator 1570 and the metal being penetrated resisting against the outside curvature 1584 of the actuator 1570, a shearing effect occurs. This affect removes a ring of plastic 1584 from the outside edge of the actuator 1570 as the rest of the actuator 1570 (Figure 19) and core particles punch through. This is known as a controlled failure because the reduction in the diameter of the face of the actuator 1570 makes penetration easier and enough of the interior angle remains intact to facilitate the proper spread of core particles into the second and third phase of their flight To achieve this the actuators are preferably manufactured from a high-density polyethylene, or its equivalent. The material must have a combination of rigidity and toughness to punch through residential type partitions, walls, doors, car windshields and bone without breaking or tearing yet be flexible enough to enter into controlled failure upon impact with a dense obstacle. The use of an extremely hard material, such as polycarbonate, prevents the actuator from entering into the controlled failure illustrated. As illustrated in Figures 22 – 24, using material that is too soft, or a stem that is too narrow, enables the stem and particle to punch through the actuator face, leaving a large, free floating ring.

The penetration power required to pass through sheet rock, that is, a residential interior wall, for example, is less than that required to penetrate the metal plate and the actuator would not deform as in the case of penetration through the metal plate.

The initial transformation of a unitary slug to a unified projectile of increasing diameter is achieved by rapidly separating the plurality of unified particles from the housing within which they are contained. If the separation step from the housing, or hull, is too slow, then the particles will spread too slowly and will continue to function as small diameter penetrating projectile and will continue to have too much penetration capability and thus continue to be lethal, over an extended distance. If the expansion is too rapid, then the particles lose their incapacitating force too rapidly, eliminating the capability to incapacitate a terrorist standing behind a wall or protected by a car windshield.

To control the transformation the hull is torn away from the particles at a predetermined rate, thus producing a predetermined rate of expansion of the path that the particles follow subsequent to the initial impact of the projectile with an object. The controlled separation of the particles from the hull can be achieved by peeling the hull back upon itself as a result of the contact of the hull with an object having a predetermined density. The peel back rate of the hull must be controlled so as to release the particles within, preferably, about from .0005 to .0001seconds. This would occur upon penetration of a typical residential partition wall, wooden wall or car windshield.

By way of further contrast with the prior art projectiles, in the present invention, the hull travels with the contained core materials until impact, peeling back upon impact to free the core particles. The amount of resistance necessary for the hull to peel back is very low. Although automobile, safety glass or gypsum board will produce peel back, single pane window glass will not produce peel back. A sheet of cardboard, a corrugated box, a sheet metal panel, a plastic container filled with water, flesh and

body organs, are all within the category of materials that will produce the peel back effect. A sheet of paper is typically insufficient to produce the peel back of the hull.

If peel back occurs cleanly, all lead core particles leave as a single mass and fly that way for some distance, up to about several feet in open air. For the first two to three feet, the core particles have a single body effect. The core is continually expanding and about 3 to 6 feet later the lethal effect of the core decreases substantially. Up to about a four inch diameter the core particles produces an impact comparable to that of a single slug. A ten inch diameter for the zone of the core particles, produces thousands of individual particle impacts and consequently is far less lethal.

Figure 8 shows a projectile 800 penetrating a shielding target 810, as for example a car window, a door or even a relatively viscous mass. The hull 808 begins to peel back and the core particles 804 begin to become free of the containment by the hull. The core particles 804 and the actuator 806 are, as the hull open end 802 is peeled back, released as a core unit from their containment within the hull 808. If the hull peels back progressively, the core particles are released progressively. If the hull immediately disintegrates, the pellets disperse in an uncontrolled manner and the core particles immediately lose their capacity to be lethal.

Figure 9 shows the projectile 800 leaving the shielding target 810 with the hull upper end 802 peeled back upon the crush zone 812. The peeled back section of the hull 808 can be peeled back to the point where the upper most edge 802 extends all the way to the projectile end 814. That is, the projectile 800 can be folded fully upon itself. The peel back must approximate the rate of travel of the core particles, (projectile velocity) in order to obtain the controlled core particles release illustrated in Figure 9. With a controlled release, the particles remain clustered and continue to function as a unitary mass, with the exception of a slightly greater diameter than when contained within the hull and of the

actuator 806.. The core particles are seen to spread over a region of greater diameter than the diameter of the actuator 806, but still are substantially within a unitary grouping.

When passing through a solid or viscous object, the hull 808 peels away and actuator 806 and core particles 804 continue on a forward trajectory along a radial dispersion path. The orientation of the actuator 806 is maintained consistent due to the interaction between the core particles 804 and the stem 816. The stem 816 cannot deviate substantially from the initial path, since the core particles 804 surround the stem 816 and restrict the movement of the stem 816 other than along a path along the stem's axis. The core particles 804 disperse radially, and start losing their lethal force after about three feet (one meter) from the point of initial impact. Thus the core particles initially impact as a cohesive, unitary body and rapidly disperse radially to the point where they are non-lethal individual particles. The unitary core particles can punch through steel plate 1/16 of an inch thick, but after about three feet of travel have degraded into individual non-lethal particles that are traveling in diverse directions, with little forward momentum.

As the hull 808 folds back, the actuator 806, followed by the core particles 804, is released and continues the forward momentum. The mass of the core particles 804 begins to elongate and spread, but remains behind the actuator 806.

For the first three to four feet of travel after core particle release, a pressure wave 818 precedes the actuator 806 and mass of core particles 804 and produces a low pressure area around the actuator and mass of core particles. Thus the actuator 806 encounters little wind resistance, even though it presents a broad, flat surface.

In the first few feet of flight the blunt design of the actuator results in its being dragged along behind the pressure wave 818. Individual particles have a low resistant to air and thus would not

produce this pressure wave effect, or be pulled by the vacuum zone produced by the pressure wave. Thus, when the actuator is preceded by a pressure wave, the discrete particles follow the actuator and act as a cohesive mass. Usually within seven to ten feet from release from the hull the pressure wave dissipates, and the actuator's blunt shape causes it to offer high resistance and slow down and/or deviate from its straight-line trajectory. The particles at that point disperse radially to the point where they do not impact as a unitary mass, but rather impact as non-lethal individual particles.

This pressure wave effect is dramatically amplified within highly viscous material such as the internal organs of the human body, and becomes a highly destructive force in and of itself. Figure 10 illustrates the effect of the disclosed projectile when the primary and secondary impact area is a body. As seen herein, the pellets 804 are preceded by a broad, essentially flat pressure wave represented by lines 1000 and thus impact the secondary target 1002 of an organ, over a wide area. The pressure wave 1000 impacts the surface 1004 of the secondary target 1002; driving the surface 1004 away from the advancing actuator 806 and mass of core particles 804.

The force of the pressure wave 1000 can cause a severe trauma over a very large area and can virtually liquefy a body organ. Thus, the effective impact area is substantially larger than the area of the actuator 806 or the mass of core particles 804.

The point of initial impact determines the damage done to a body upon impact by the actuator and core particles. If the initial impact is through a car window or partition wall and the body is hit, within about three (3) feet from the initial impact, the actuator and particles will penetrate the skin and organs nearer the surface and deliver a heavy blunt trauma impact. If, however, the initial impact is through a wall and the body is ten (10) feet beyond the point of exit, the damage will be minimal, if any.

When the initial impact is a body, the peeling back of the hull and release of the core particles takes place within the flesh and the actuator and core particles go on to penetrate the internal organs. Because of the density of the body, the core particles are slowed much faster, therefore remaining within the body. This prevents any accidental injuries due to a bullet passing through the body of initial impact and hitting a second person. Additionally, because of the viscosity of the internal organs, the pressure wave will do extensive damage to organs as it moves through the body, to be stopped at surface of the impacted cavity opposite the point of entry by the surrounding skin and flesh. The elasticity and strength of surface muscle, bone and skin structure, combined with the slowing of the pressure wave, causes the pressure wave to recoil back toward the point of entry.

It is the pressure wave created by the projectile's momentum that maintains the core particles 804 within the precise formation behind the actuator 806. As expansion occurs the pressure wave dissipates and becomes insufficient to make a path for the actuator 806. That is, when the air resistance dampens the forward movement of the actuator 806, as illustrated in Figure 13, the particles begin to radially disperse. When the projectile does not contact a secondary target, the particles 804 will disperse due to the air resistance preventing the particles from traveling a substantial distance. Once the particles have been slowed due to air resistance, as illustrated in Figure 13, the particles act as non-lethal individual particles. This dispersal must occur within a zone that is from about seven feet to within about ten feet from the point of initial impact.

The expansion of the core particles starts immediately upon peeling away of the hull, however, to only a limited extent. The pressure wave leads, followed by the actuator, and core particles. The core particles tend to stay in a cohesive group initially, preferably for about three to six feet. The projectile design is such that the pressure wave dissipates rapidly and after travel through the initial

zone in which the cohesive mass of particles form a unitary lethal mass, the particles are not tightly packed around the centering stem of the actuator and the actuator no longer travels along a straight trajectory.

As stated heretofore, the speed of the peel back is critical. Figures 11 and 12 show what happens to the core particles 1102 when the peel back of the hull 1100 is partial, or too slow, thereby preventing simultaneous release of the core particles 1102. When the hull 1100 passes through the initial impact area and remains in the configuration illustrated in Figure 11, a portion of the core particles 1102 will remain within the hull 1100. If the hull 1100 continues to slowly peel back, moving into the configuration of Figure 12, the particles 1102 start to exit between the actuator 1104 and the hull 1100, since the actuator 1104 is being slowed by the stem 1106, still retained within the particles 1102. This causes the particles 1102 to immediately start dispersing, spreading laterally, while degrading from a unitary mass to independently acting particles. The partial or slow peeling of the hull results in a lengthening of the secondary zone and increased instability of the actuator 1104.

The core particles within inches of leaving the hull 1100 reach the final broad radial dispersion illustrated in Figure 13. In a slow, or uncontrolled, peel back, the distance between initial impact and the final broad radial dispersion is undeterminable due to the unpredictability of the separation. This can also occur if the hull tears or splits due to structural irregularities, as the particles will disperse through the tears in the hull in an uncontrolled manner, and will no longer act as a unitary mass.

It should be noted, however, that planned splitting of the hull, due to predetermined scoring of the hull materials, will cause the hull to split. In this embodiment, however, the scoring at a depth that will enable the split to occur in a timed manner to release the core particles in a controlled manner. Figure 14 illustrates the continued path of the core particles 1102 pellets when the peel back is too

SLOW. In the event of a tearing of the hull, the dispersal would be similar but would be in an inefficient and irregularly shaped star burst form, when viewed three dimensionally.

Although the broad radial dispersal of Figure 13 is the desired end point, the projectile as disclosed herein, does not reach that point until seven (7) to ten (10) feet after leaving the hull. The slow hull peeling illustrated in Figures 11 and 12 would make the projectile ineffective for a secondary impact if it had to pass through an initial shield, such an auto windshield or residential partition wall.

EXAMPLE I

The target was a residential type interior partition wall with a single layer of one half inch thick (1/2") gypsum board on each side of a standard stud wall. The projectile was a shell having a mass of 7000 small pellets as core particles confined within a hull. The leading, open end of the hull, was closed by a thumbtack like actuator. During the penetration of the wall the hull peeled back, releasing the actuator and the mass of particles. For a distance of about three feet, the mass of particles traveled in a confined zone, as an expanding but unified mass of particles. The mass of core particles had a center core of dense packed particles with a spreading fringe of individual particles. At the end of three (3) feet, the particles had a radial dispersion diameter of about two inches. The pressure wave then dissipated to the point where drag set in and at a distance of about seven (7) to about ten (10) feet, the intermediate zone of the pellets expanded to form a large diameter zone of less lethal individual acting pellets. Impact with the pellets against a target just beyond ten (10) feet from the point of initial impact, could cause abrasion but would not be lethal.

EXAMPLE II

The targets were seventeen (17) to eighteen (18) pound whole pork shoulders. A one- inch thick plywood sheet barrier was placed 36 inches behind the shoulder directly within the line of fire.

The aim point was the heavy muscled area just over the shoulder joint itself and would create a projectile path from the outside of the shoulder toward where the shoulder would attach to the animal.

Using several different types of conventional ammunition, the projectiles passed through each pork shoulder and on through the plywood barrier.

In the test firing using the disclosed projectile the one inch plywood sheet barrier was replaced with a ½ inch thick piece of sheetrock. It was determined that if the projectile, or any part of the pork shoulder penetrated the sheetrock, that configuration of the projectile would be considered a failure.

Using the projectile as disclosed herein, the shoulder joint was cleanly separated and blew through a large hole in the back of the shoulder. The paper on the surface of the sheetrock was slightly cut from either the projectile casing or a bone fragment but was otherwise undamaged. Neither the joint bone or cartilage material was marred by the projectile or core particles. Forensic dissection of the shoulder later reviled that the vast majority of core particles had expended their energy inside the shoulder and stopped before reaching the joint itself. The indication was that the shoulder joint had been cleaved from the rest of the bone structure by a pressure wave that had been built up inside the pork shoulder and preceded the expanding projectile through the impact area.

Under normal circumstances, neither the casing nor the bone would have passed through the body due to the viscosity of a living body. Since the pork shoulder consists of dry tissue, and the viscosity is reduced, the dry tissue and bone "bunched" behind the actuator, exiting slightly at the back of the shoulder

Surprisingly, the actuator is almost perfect after impacting the eight-inch thick pork shoulder. The pressure wave blows out an area about four times that of the original projectile diameter.

EXAMPLE III

For example, in the case of a steel drum filled with water and having a 10 inch diameter and 18 inch high, of a fairly high gauge steel, the impact of the projectile of the present invention rips out the front but does not effect the back wall. There is a rebound of the pressure wave, that is, a water hammer effect.

The rebound hydraulic shock can be four times the impact of the initial pressure wave. The present invention projectile, unlike prior art projectiles, produced large bulges at the side and top of the steel drum, but no exit hole. The shock wave does massive damage, and the blunter the nose and the faster the expansion, the greater the shock wave.

A penetrating bullet takes the shock wave with it through the exit opening. A full metal jacket projectile has a very high penetration force and will pass cleanly the same type of container, creating minimal budlging and only a small entranced and exit hole. Thus, the diameter of the trauma zone is very small. In the case of the penetration of a heart it may take an extended period of time for the target to succumb to the wound, due to bleeding. The projectile of the present invention, however, can produce an actual projectile expansion of four (4) to five (5) inches in diameter and a highly destructive ten inch diameter shock wave. Since the projectile does not exit the body there is a shock wave rebound and a huge trauma zone.

EXAMPLE IV

In order to determine the lethal range of the core particles after encountering an initial impact area, two layers of denim placed three (3) inches in front a sheet of plywood. The disclosed projectile was shot through an impact media ten (10) feet in front of the denim and plywood backstop. If the core particles caused any substantial damage to the plywood, or deeply embedded into the plywood,

the test was considered unsuccessful. When the core particles were slightly embedded into the plywood and could be easily brushed off, the test was considered successful.

The above tests would also be applicable to different distances and the distance adjustments would be obvious to those skilled in the art when read in conjunction with this disclosure.

Figure 15 illustrates a preferred embodiment of the hull 1500, in which the hull wall 1502 is gradually tapered. The wall 1502 thickness is greater at the base edge than at the leading edge or open end. This design is used to precisely control the rate of peel back of the hull 1502. By increasing the overall thickness the hull 1502, the peel back rate will be slowed and, conversely, narrowing the thickness will increase the rate of peel back. The taper enables the peel back to start quickly while the thicker bottom maintains the necessary rigidity. If the hull has a uniform thickness, the initialization of the peel back can be too slow the effectively release the core particles simultaneously. The peel back rate must be equal to that of the velocity of the projectile in order to provide the controlled release. Generally the peel back rate is between about .0005 and .0001 seconds. Therefore, as the velocity of the projectile is changed, through projectile size, power type or other customizations, the peel back rate is adjusted accordingly.

Another method of controlling the peel back rate is to score the hull. The number and depth of the score lines directly affects the rate of peel back. Although this is not as reliable as tapering the hull, as too many scores or too deep a scoring will cause the projectile to explode upon first impact, there are specific situations where this would be of value. Scoring the hull deeper than 50% of the hull thickness over compromises the hull.

The actuator design is chosen to facilitate the controlled flight of the core particles, or pellets. As illustrated in Figure 16, an actuator 1550 with a conical region 1506 that merges at its apex end

with a longitudinal stem 1504, has been found to prevent the actuator lead surface 1502 from shearing away on impact. If the lead surface 1502 shears upon impact, the core particles continue to travel as a unitary mass for an extended period of time, thus extending the secondary lethal zone well beyond the preferred maximum distance of ten feet required in this embodiment. Additionally, the without a conical region, the stem can break through the front surface and be propelled forward similar to a slug. This configuration would be used in embodiments where the secondary lethal zone is extended, in a controlled manner, to meet specific law enforcement needs.

The optimum cone angle to achieve the three (3) to seven (7) foot lethal zone is about 40° to 60° from the centerline and preferably in the range of 55° to 58° fron the centerline. The lethal zone can be adjusted by changing the cone angle, peel back rate and core particle size. For example, a 40° angle almost eliminates the lethal secondary zone, as the energy of the core particles dissipates immediately. Having an angle of less than 10° doubles the lethal zone if all other factors are the same. The actuator 506 of Figure 7 would be an example of an extended lethal zone.

Figure 17 illustrates an actuator 1570 that has a lesser conical region 1572 than the embodiment of Figure 16. Although a lesser angle is used for the conical region 1672, the stem 1574 has a wide diameter to prevent the stem from penetrating the actuator face 1576 and continuing forwarding as a slug. The actuator 1600 illustrated in Figure 18 has a conical region 1602 of less than maximum diameter and the use of a narrower stem 1604. Although the narrow stem 1604 is not recommended for applications with a short lethal range, it can be advantageous in specific applications, as will be evident to those skilled in the art. The wide stem also keeps the mass of the core particles away from the actuator mid-point, minimizing the tendency of the core particles to penetrate the center of the actuator head upon impact. Such central penetration can result in a random dispersion of particles.

The spherical core particles can be substituted with fragmented plates that will shred whatever surface they come in contact with. This can be advantageous as it will more effectively penetrate the sheet metal body panels of an automobile, shred the interior, and not exit the other side. The same result is achieved when the spherical core particles are replaced with washer type plates. It should be noted that solid flat plates will not provide the same result. Without the center hole, the flat plates turn on edge and will travel for long distances. The center hole creates aerodynamic instability causing the plates to flip at high rotational speeds decreasing their range of flight and increasing the damage as they rotate.

An alternate to the foregoing peel back method is illustrated in Figures 25 and 26 in projectile 2500 wherein the hull side 2502 is scored along the base score line 2504, providing a weakened breaking point. In this embodiment, the wad 2506 has a diameter smaller than that of the hull side 2502 to enable the hull side 2502 to slide over the wad 2506 and rest on the gas seal 2510. The score line 2504 fails under pressure and, as it slides back in response to the air pressure, the actuator 2508 and core particles 2512 are released.

In Figure 25 an alternate embodiment uses a bonding agent to maintain the core particles 2600 in a consolidated cylindrical form. The conventional crush section 2602 serves as a base unit while the actuator 2604 serves as a top portion. The actuator 2604 works in the same way as previously described. Upon initial impact the bonding agent holding the core particles in a cohesive form shatters, thereby releasing the core particles 2600 to follow the actuator 2604 as described herein. Alternatively the actuator can be eliminated and the core particles bonded into a cylindrical unit affixed to the crush section. As stated above, upon impact the bonding agent would shatter, releasing the core particles. This embodiment would not have the control of expansion after impact provided by the foregoing

embodiments incorporating the actuator, however in specific applications this embodiment could provide advantages.

The use of a blow mold grade low density polyethylene has been found to provide a hull material that will allow the hull to peel back completely, without tearing, and at the desired rate. The actuator is preferably formed from high density polyethylene. The use of a very rigid polymer or other material, such as a carboxylate, is not preferred, because of the tendency to be too rigid on impact.

It should be noted that for simplicity in description, the term shot gun shell is used herein as representing the primary application of the ballistic projectile of the present invention. However, the principles also apply to handgun ammunition and other types of ballistic projectiles.

What is claimed is:

1. A projectile comprising a gas seal, wad absorption zone, a core hull, a mass of projectile core particles within the hull and an actuator member, said actuator member being releasably fixed to the hull and having at least one stem member, said at least one stem member projecting into said mass of projectile core particles, said actuator member being at the impact end of said hull and said absorption zone being upstream of said core particles.

2. The projectile of claim 1, wherein said hull is a soft plastic that is characterized by peeling back on itself on impact, thereby releasing said mass of core particles.

3. The projectile of claim 1, wherein each of said core particles have a diameter substantially in the range from about .02 of an inch to about .13 of an inch.

4. The method of impacting a target with a projectile, said projectile comprising a gas seal, wad absorption zone, a core hull, a mass of projectile core particles within the hull and an actuator, said actuator being releasably fixed to the hull, said actuator being at the impact end of said hull and said absorption zone being upstream of said core particles, comprising the steps of firing said projectile at a target, impacting a target with said projectile, generating a pressure wave in advance of said projectile, peeling said hull backward upon itself and releasing said radial dispersion control member and said mass of projectile core particles, said radial dispersion control member initially maintaining said projectile core particles in a confined zone, within said confined zone said mass of projectile core particles having an impact effect substantially equivalent to that of a unitary projectile, thereafter

dispersing said projectile core particles in an progressively expanding pattern such that the particles travel as substantially discrete individual particles and upon impact with a secondary target produce a plurality of individual impacts.

5. The method of claim 4, wherein said core particles substantially start passing said radial dispersion after traveling at least about six feet from the impact of said target.

6. The method of claim 4, wherein said actuator has a stem member, the core particles enclose said stem member, and said projectile core particles are maintained in a substantially confined zone for a distance of up to about six feet.

7. The method of impacting a target with a projectile, said projectile comprising a absorption zone, a hull, a mass of projectile core particles within the hull and a actuator, the actuator being releasably fixed to the hull, said actuator being at the impact end of said shell and said absorption zone being upstream of said core particles, comprising the steps of

a- igniting an explosive charge thereby projecting said projectile,

b- absorbing said explosive charge impact and preventing said core particles from compressing into a unified structure,

c- maintaining said core particles contained within said hull until a target is impacted by said projectile,

d- impacting a target,

e- upon impact with said target, peeling said hull back upon itself and thereby releasing said mass of core particles from their containment within said hull.

8. The method of claim 7, further comprising the step maintaining said core particles in a substantially cohesive mass for a distance of at least about three feet, and radially dispersing substantially said entire mass of core particles at least about three feet after the impact with said target.

9. The method of claim 7, further comprising the step of producing a zone of lethal impact by maintaining said core particles in a substantially cohesive mass behind said actuator after initial impact with said target.

9a- The method of claim 9, wherein said lethal zone extends at least about three feet from the point of impact with said target.

9b- The method of claim 9a, wherein said core particles substantially separate from and start passing said actuator after traveling at least about six feet from impact with said target.

10. The method of claim 7, further comprising the step of initially maintaining said projectile core particles in a confined zone, within said confined zone said mass of projectile core particles having a lethal impact effect substantially equivalent to that of a unitary projectile, thereafter dispersing said projectile core particles in an progressively expanding pattern such that the particles travel as substantially discrete individual particles and upon impact with a secondary target produce a plurality of non-lethal individual impacts.

11. The method of claim 7, wherein said confined zone is up to about six feet from the impact with said target.

12. The method of claim 11, wherein said confined zone is up to about three feet from the impact with said target.

13. The method of impacting a target with a projectile, said projectile comprising a absorption zone, a hull, a mass of projectile core particles within the hull and a actuator, the actuator being releasably fixed to the hull and an actuator, said actuator being at the impact end of said shell and said absorption zone being upstream of said core particles, comprising the steps of

a- igniting an explosive charge thereby projecting said projectile,

b- absorbing said explosive charge impact and preventing said core particles from compressing into a unified structure,

c- maintaining said core particles contained within said shell until a target is impacted by said shell,

d- impacting a target,

e- upon impact with said target, releasing said mass of core particles from said hull as a cohesive group of lethal individual particles, and

f- thereafter radially dispersing substantially said entire mass of core particles to produce a mass of non-lethal individual impact particles.

14. The method of claim 13, wherein said step of releasing said mass of core particles from said hull as a cohesive group of individual particles, further comprises maintaining substantially said entire mass of core particles in a confined zone behind said actuator, said actuator being maintained in a substantially straight line trajectory by core particles that engage said actuator.

15. The method of claim 13, wherein, upon impact of said projectile with said target, the forward movement of said actuator is preceded by a shock wave, said target being initially impacted by said shock wave.

16. The method of claim 13, further comprising the step of initially maintaining said projectile core particles in a confined zone after releasing said mass of core particles from said hull as a cohesive group of individual particles, within said confined zone said mass of projectile core particles having a lethal impact effect substantially equivalent to that of a unitary projectile, thereafter dispersing said projectile core particles in an progressively expanding pattern such that the particles travel as substantially discrete individual particles and upon impact with a secondary target produce a plurality of non-lethal individual impacts.

17. The method of claim 16, wherein said confined zone is up to about six feet from the impact with said target.

18. The method of claim 17, wherein said confined zone is up to about three feet from the impact with said target.

19. The method of impacting a target with a projectile having a plurality of small particles encased in a hull, comprising the steps of:

a) separating said hull from said plurality of small particles upon impact with a target,

b) maintaining said plurality of small particles in the form of a cohesive mass of lethal particles for a distance of at least about two feet from the point of impact with said target,

c) thereafter breaking apart said cohesive mass of particles into individual non-lethal, radially dispersing particles.

20- The method of claim 19, the step of initially maintaining said plurality of small particles in the form of a cohesive mass of particles provides said plurality of small particles with a lethal impact effect substantially equivalent to that of a unitary projectile.

21- The method of claim 19, wherein breaking apart said cohesive mass of particles causes that particles to act as discrete individual particles and upon impact with a secondary target produce a plurality of individual non-lethal impacts.

22- The method of claim 21, wherein said particles break apart and act as discrete individual non-lethal particles after traveling no greater than about ten feet from said point of impact with said target.

23- The method of claim 22, wherein said particles break apart and act as discrete individual particles after traveling no greater than about six feet from said point of impact with said target.

24- The method of claim 23, wherein said particles break apart and act as discrete individual particles after traveling no greater than about three feet from said point of impact with said target.

25- The projectile of claim 19, wherein said hull is a cylindrical member having an open end, said actuator having an exterior side and an interior side and being releasably fixed to said hull open end to close said hull open end, whereby said actuator is released from its being releasably fixed to said hull open end upon impact with a target.

26- The projectile of claim 25, wherein said hull has an internal channel proximate its open end and said actuator has a peripheral, circular ring mounted in said hull internal channel.

27- The projectile of claim 25, wherein said actuator has a truncated conical section having tapered sides, said tapered sides having its greatest radial dimension at its exterior side.

28- The projectile of claim 27, wherein said at least one stem member is a centrally positioned cylindrical member.

29- The projectile of claim 26, wherein said actuator has a truncated conical section having tapered sides, said tapered sides having its greatest radial dimension at its exterior side, and said circular ring being on the interior side of said truncated conical section of said actuator.

30- A method of controlling the release of energy from a projectile upon impact, comprising the steps of controlling the expansion of the projectile by;

a- converting said projectile upon an initial impact from a unitary structure to an expanding body of individual particles,

b- maintaining said individual particles as a unitary mass of particles for a predetermined first distance, and thereafter,

c- dispersing said unitary mass of particles into discrete particles non-lethal particles.

31- The method of claim 30 wherein said mass of unitary particles initially function as a slug in step (a) then in step (b) acts like a slug of substantially increased diameter and in step (c) disperse and are non-lethal discrete particles.

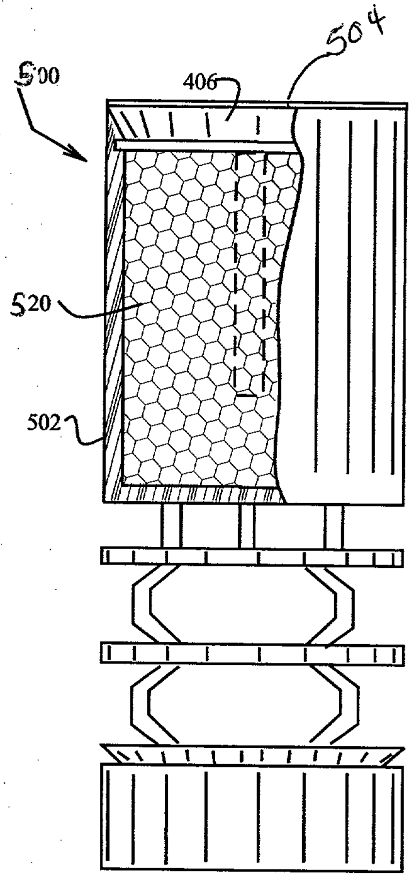
33- The method of claim 31, wherein step (c) occurs to a distance of about three feet and preferably within ten feet from initial impact.

34- The method of claim 30, wherein said controlling of the expansion of said mass of unitary particles into discrete particles projectile comprises the steps of confining said particles in a hull, tearing said hull away from the particles at a predetermined rate, thus producing a predetermined rate of expansion of said particles immediately subsequent to said initial impact.

35- The method of claim 34, wherein said hull is peeled back upon itself as a result of the contact of said hull with an object.

36- The method of claim 35, wherein said peel back of said hull is controlled so as to release said particles within, on the order of about one thousandth of a second.

37- The method of claim 34, further comprising maintaining said unitary particles substantially confined by a substantially planar member for up to at least about one foot of travel after initial impact.



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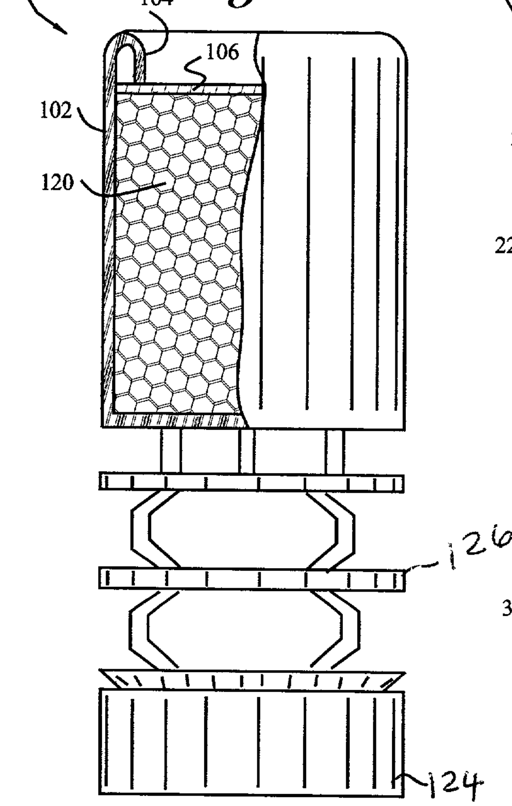

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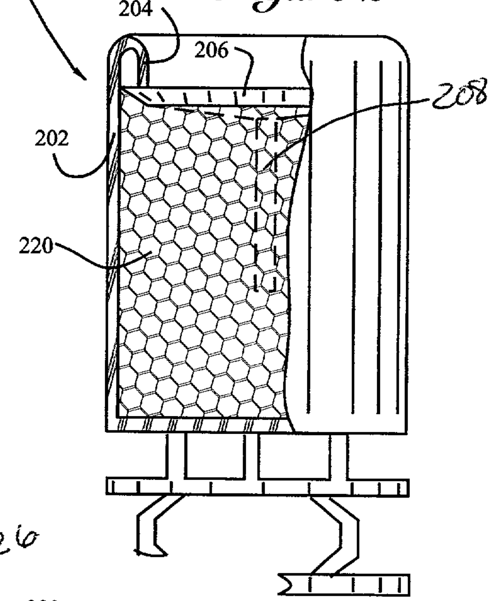

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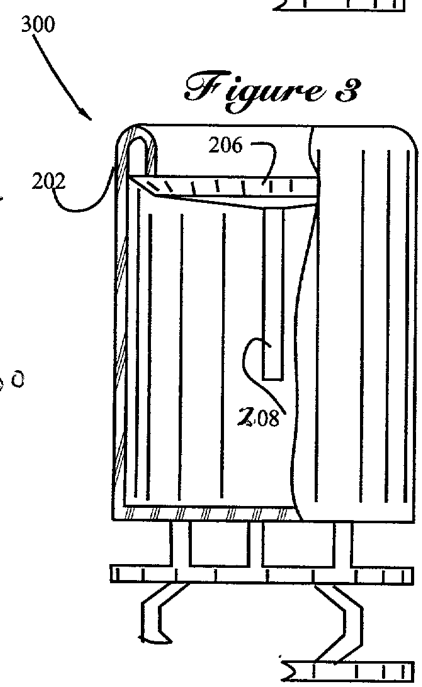

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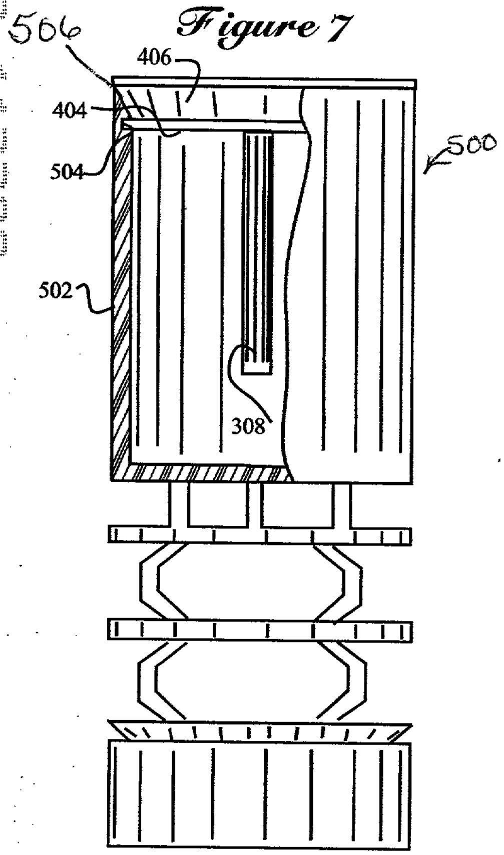

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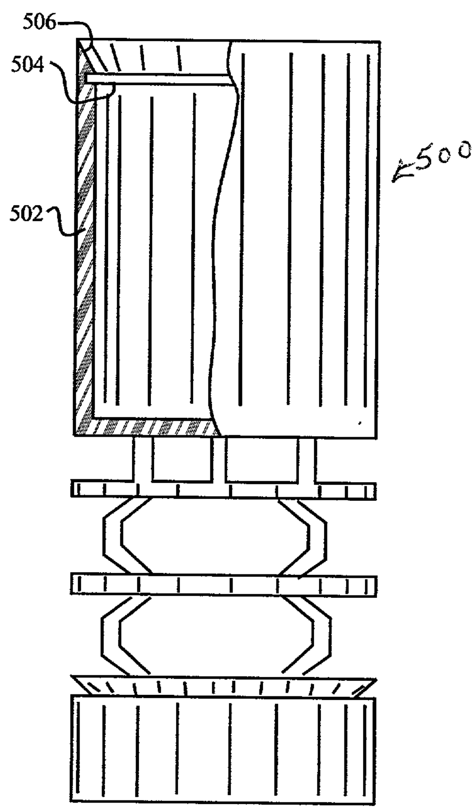

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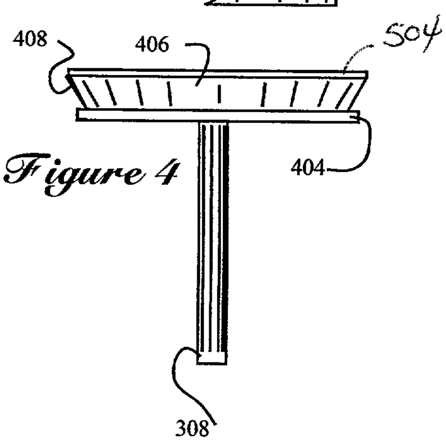

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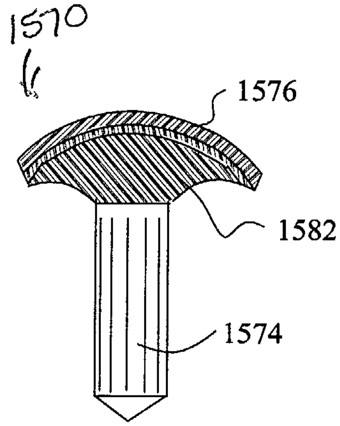

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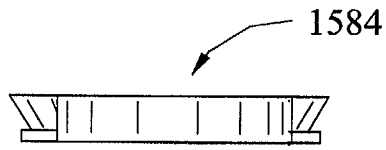

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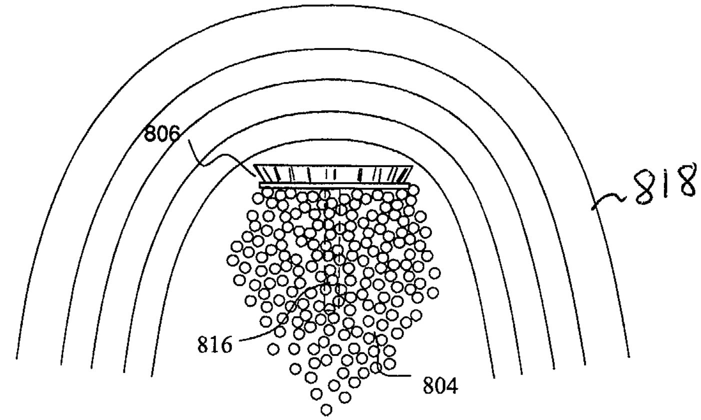

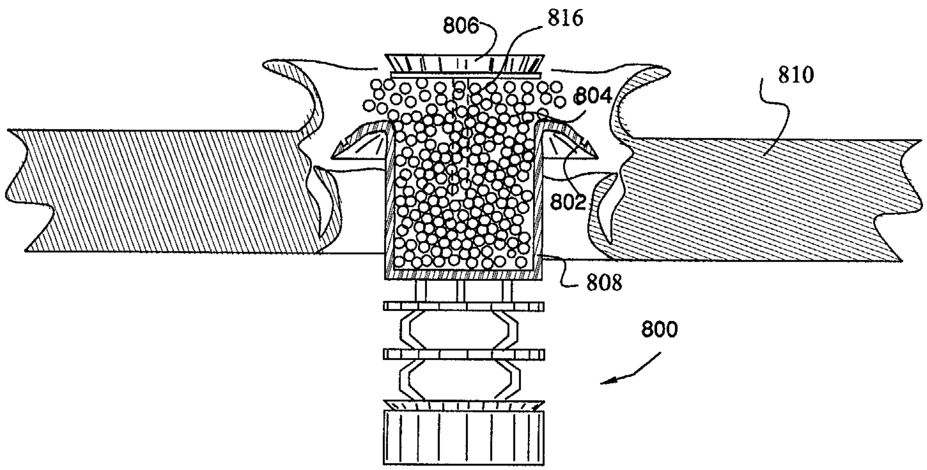

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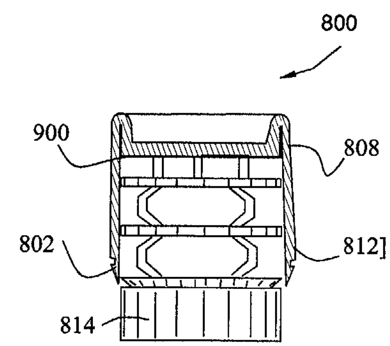

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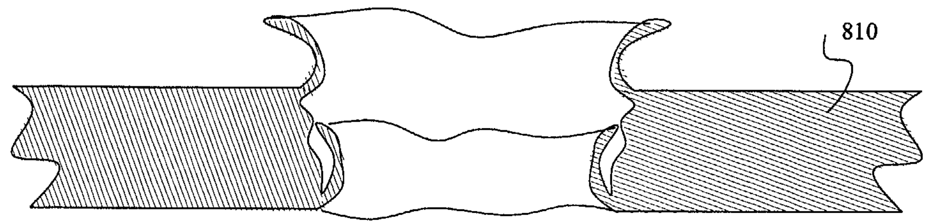

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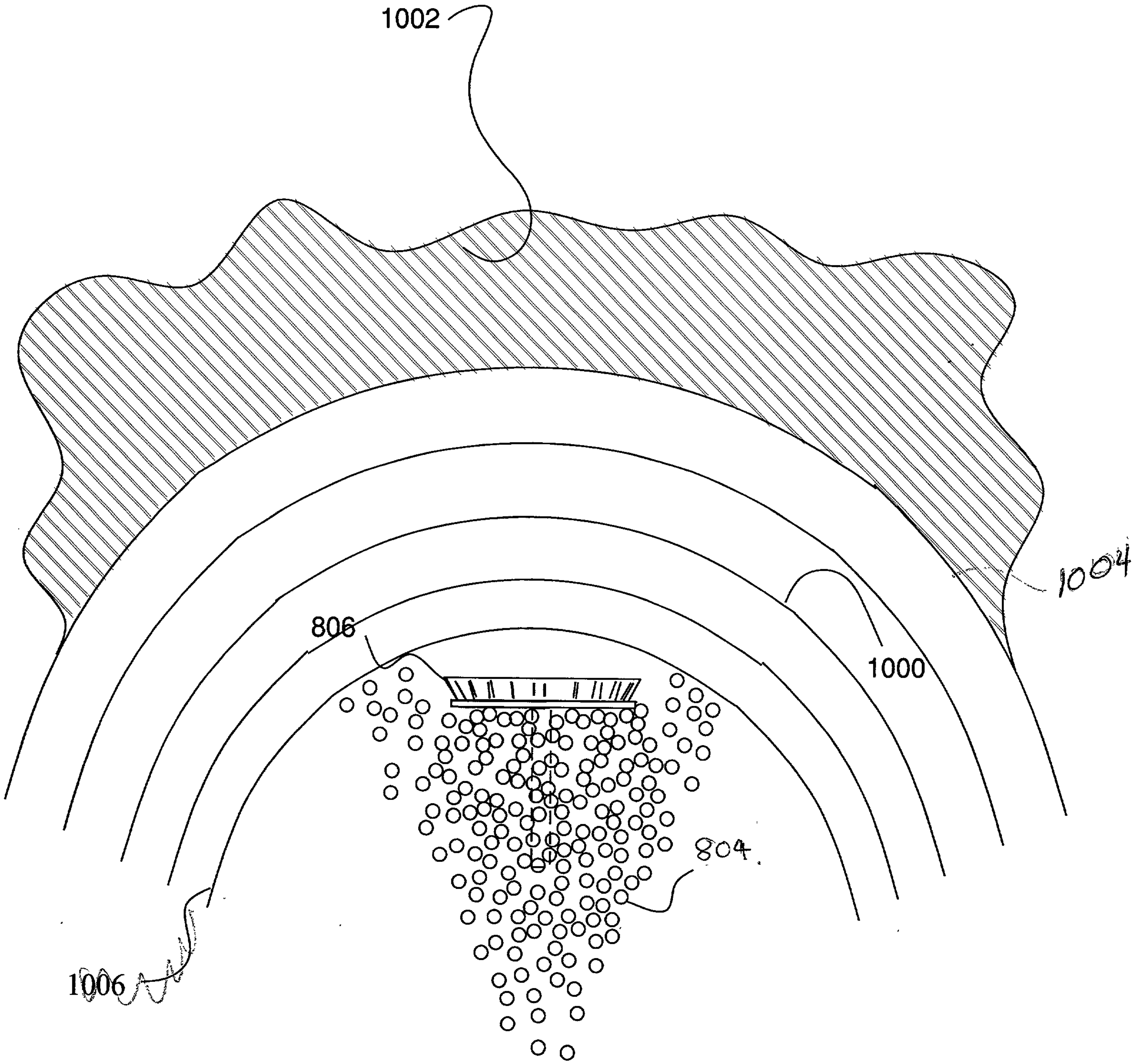

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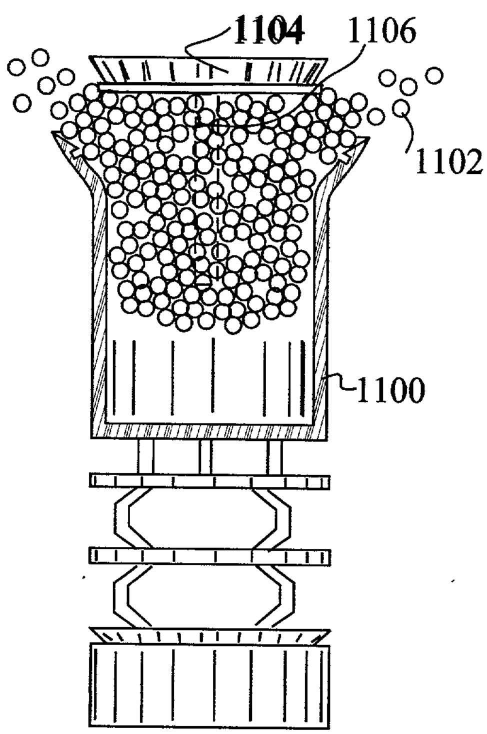

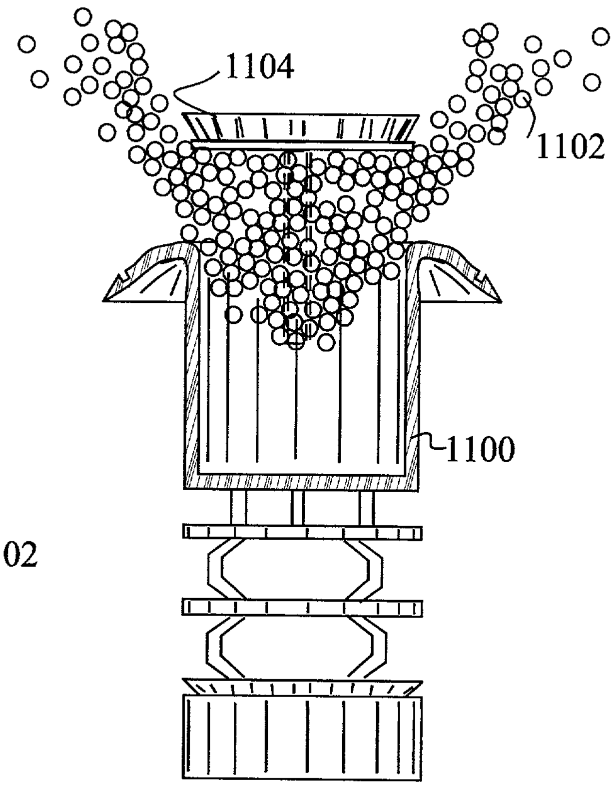

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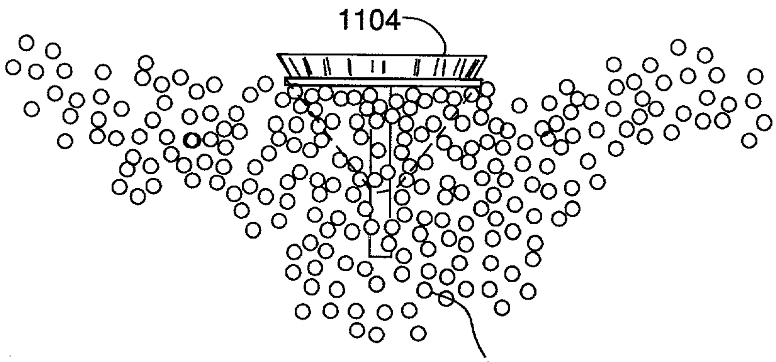

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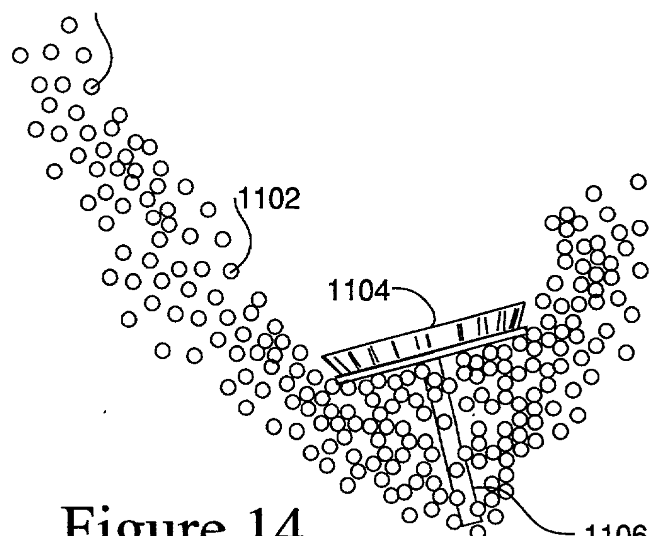

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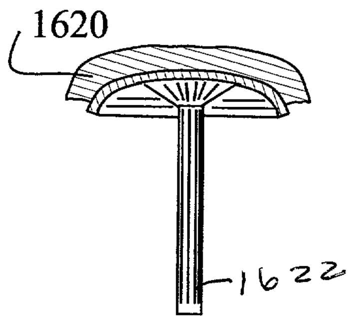

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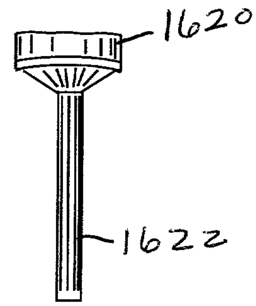

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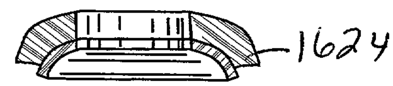

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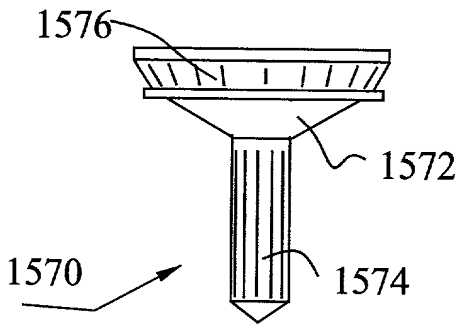

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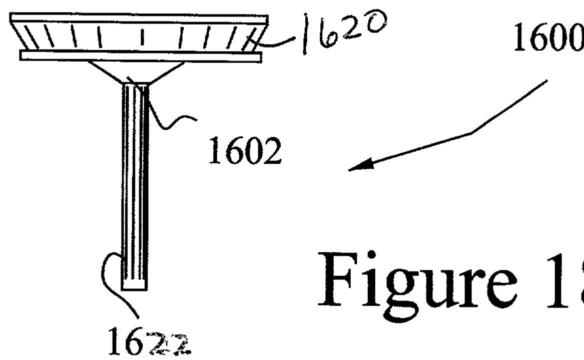
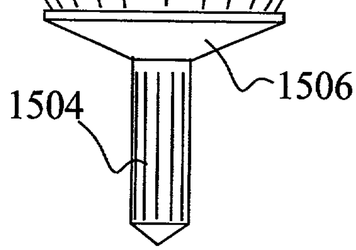


Figure 18

Figure 16



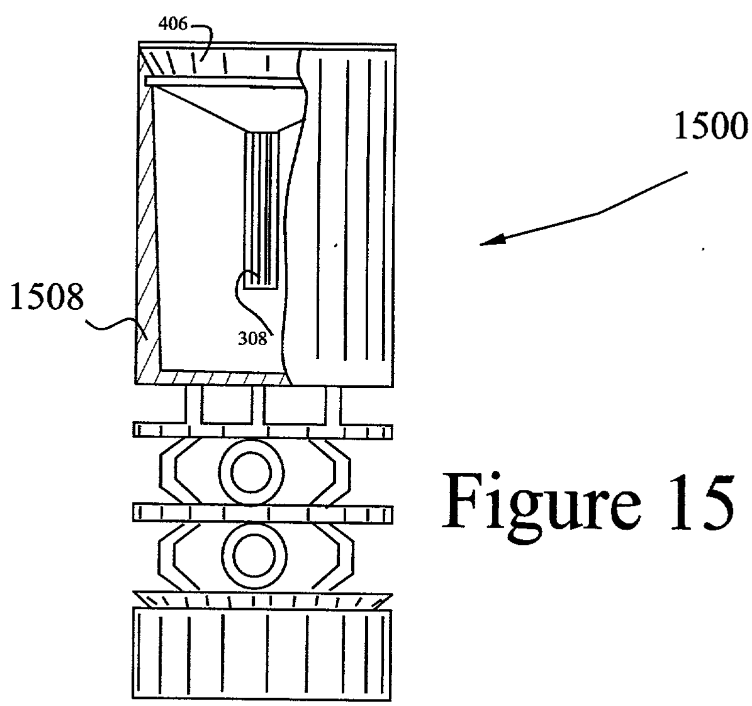


Figure 15

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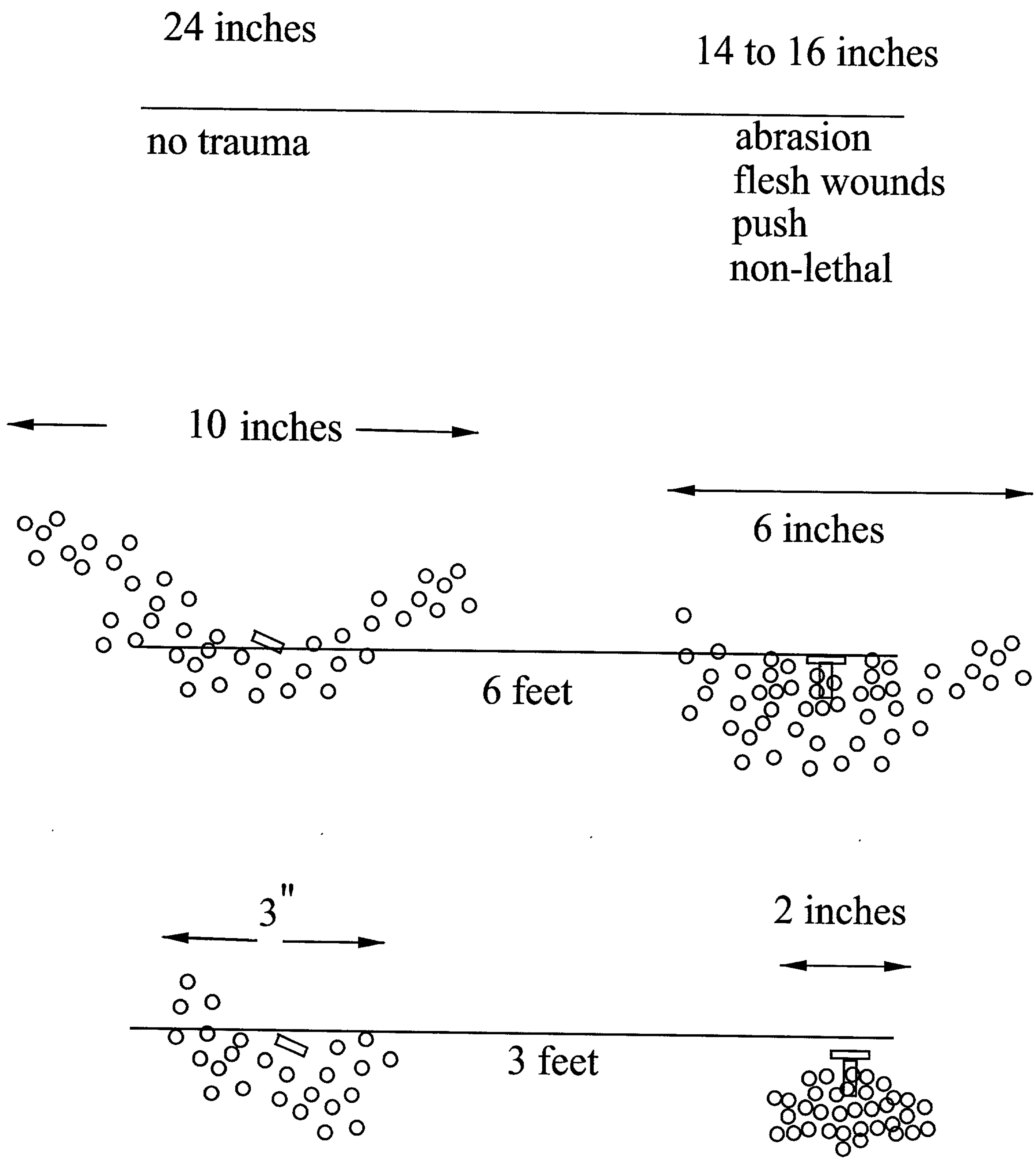
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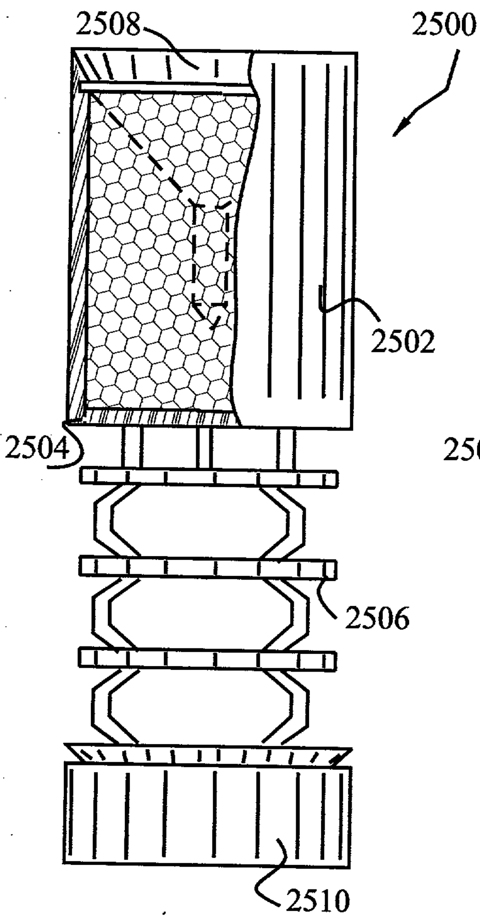

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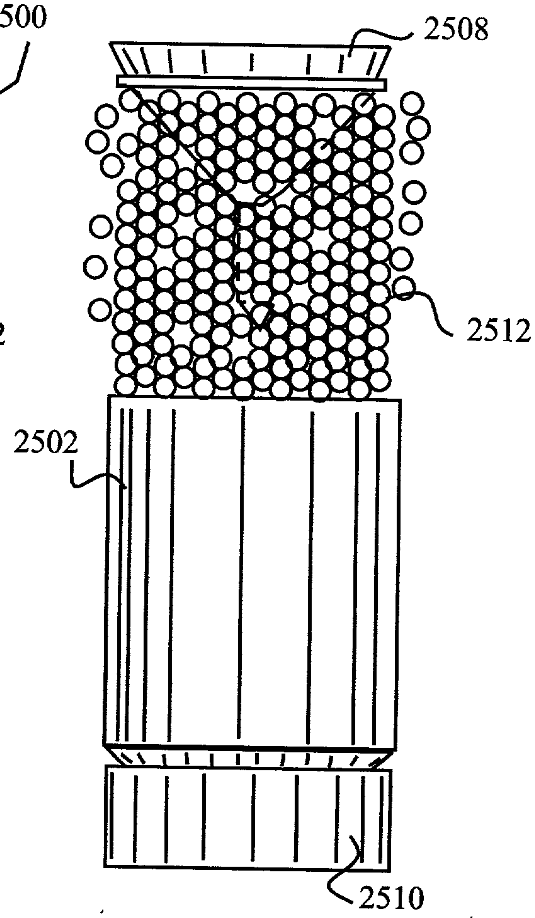

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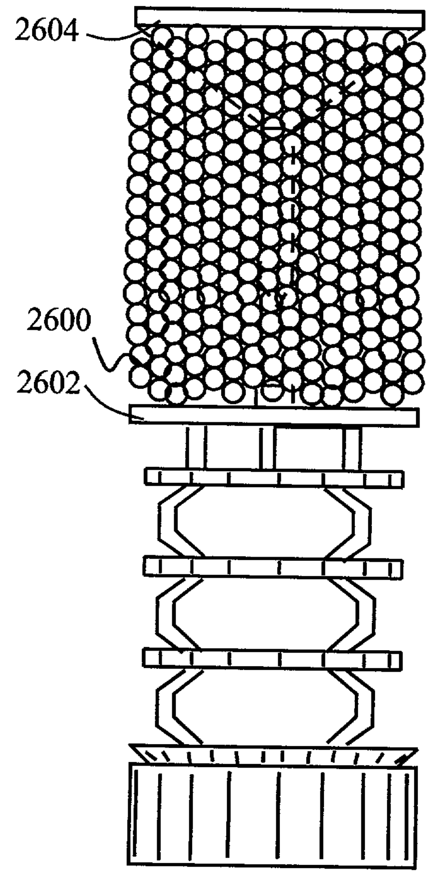

Figure 27

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

[X] Declaration Submitted with Initial Filing OR [ ] Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

Attorney Docket Number	~~GC-409~~
First Named Inventor	Charles H. Glover et al
COMPLETE IF KNOWN	
Application Number	/
Filing Date	November 22, 2000
Group Art Unit	
Examiner Name	

As a below named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Polymer Jacketed Fragmentation Type Projectile for Smooth Bore Guns

(Title of the Invention)

the specification of which

[X] is attached hereto

OR

[ ] was filed on (MM/DD/YYYY) [ ] as United States Application Number or PCT International Application Number [ ] and was amended on (MM/DD/YYYY) [ ] (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]

[ ] Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)	
		[ ] Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

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DECLARATION — Utility or Design Patent Application

Direct all correspondence to: ☐ Customer Number or Bar Code Label ______ OR ☒ Correspondence address below

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Address 300 Preston Avenue
Address Suite 300
City Charlottesville State VA ZIP 22902
Country US Telephone (804) 817-6606 Fax (804) 817-6610

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

NAME OF SOLE OR FIRST INVENTOR: ☐ A petition has been filed for this unsigned inventor

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Inventor's Signature Charles H Glover Date 11/22/00

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City Lenoir State NC ZIP 28645 Country US

NAME OF SECOND INVENTOR: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any]) Susan O. Family Name or Surname Hartley

Inventor's Signature Susan O Hartley Date 11/22/00

Residence: City Lenoir State NC Country US Citizenship US

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Mailing Address

City Lenoir State NC ZIP 28645 Country US

☐ Additional inventors are being named on the ____supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

POWER OF ATTORNEY

Docket No.

Name of Applicant: **Charles Glover et al**
Address of Applicant: **4845 Calico Road**
Lenoir, NC 28645

Title: **Polymer Jacketed Fragmentation Type Projectile for Smooth Bore Guns**

Serial No., if Any: **09/107,892**
Filed: **June 30, 1998**

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The Assistant Commissioner for Patents
Washington, D.C. 20231

Honorable Sir:
I hereby appoint:

Sheldon H. Parker 20, 738
Michael J. Donnelly 38,126
Matthew J. Raymond 45,035

as principal attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

Please direct all future correspondence to:

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300 Preston Avenue
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By: Charles H Glover
Charles H. Glover

Dated: **October 23, 2000**

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